

# FDS6982S

## Dual Notebook Power Supply N-Channel PowerTrench® SyncFet™

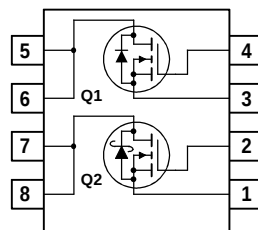
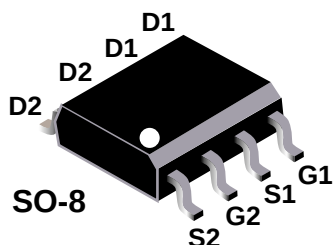
### General Description

The FDS6982S is designed to replace two single SO-8 MOSFETs and Schottky diode in synchronous DC:DC power supplies that provide various peripheral voltages for notebook computers and other battery powered electronic devices. FDS6982S contains two unique 30V, N-channel, logic level, PowerTrench MOSFETs designed to maximize power conversion efficiency.

The high-side switch (Q1) is designed with specific emphasis on reducing switching losses while the low-side switch (Q2) is optimized to reduce conduction losses. Q2 also includes an integrated Schottky diode using Fairchild's monolithic SyncFET technology.

### Features

- **Q2:** Optimized to minimize conduction losses  
Includes SyncFET Schottky body diode  
8.6A, 30V  $R_{DS(on)} = 0.016\Omega @ V_{GS} = 10V$   
 $R_{DS(on)} = 0.021\Omega @ V_{GS} = 4.5V$
- **Q1:** Optimized for low switching losses  
Low Gate Charge ( 8.5 nC typical)  
6.3A, 30V  $R_{DS(on)} = 0.028\Omega @ V_{GS} = 10V$   
 $R_{DS(on)} = 0.035\Omega @ V_{GS} = 4.5V$



### Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol           | Parameter                    | Q2  | Q1  | Units |
|------------------|------------------------------|-----|-----|-------|
| V <sub>DSS</sub> | Drain-Source Voltage         | 30  | 30  | V     |
| V <sub>GSS</sub> | Gate-Source Voltage          | ±20 | ±20 | V     |
| I <sub>D</sub>   | Drain Current   - Continuous |     |     |       |

### Thermal Characteristics

|                 |                                                   |    |                    |
|-----------------|---------------------------------------------------|----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 78 | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 40 | $^\circ\text{C/W}$ |

### Package Marking and Ordering Information

| Device Marking | Device   | Reel Size | Tape width | Quantity   |
|----------------|----------|-----------|------------|------------|
| FDS6982S       | FDS6982S | 13"       | 12mm       | 2500 units |

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                 | Parameter                                      | Test Conditions                                                                                                                                                                                                                                                                                                                                              | Type             | Min      | Typ                                                         | Max                                                | Units                |
|----------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|-------------------------------------------------------------|----------------------------------------------------|----------------------|
| <b>Off Characteristics</b>             |                                                |                                                                                                                                                                                                                                                                                                                                                              |                  |          |                                                             |                                                    |                      |
| $BV_{DSS}$                             | Drain-Source Breakdown Voltage                 | $V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$<br>$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                                                                                                                                                                        | Q2<br>Q1         | 30<br>30 |                                                             |                                                    | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$   | Breakdown Voltage Temperature Coefficient      | $I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$<br>$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$                                                                                                                                                                                                                                  | Q2<br>Q1         |          | 20<br>26                                                    |                                                    | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                              | Zero Gate Voltage Drain Current                | $V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                                                                                                                                                                                                                               | Q2<br>Q1         |          |                                                             | 1000<br>1                                          | $\mu\text{A}$        |
| $I_{GSSF}$                             | Gate-Body Leakage, Forward                     | $V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                                                                                                                                                                                                                                                               | All              |          |                                                             | 100                                                | nA                   |
| $I_{GSSR}$                             | Gate-Body Leakage, Reverse                     | $V_{GS} = -20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                                                                                                                                                                                                                                                              | All              |          |                                                             | -100                                               | nA                   |
| <b>On Characteristics (Note 2)</b>     |                                                |                                                                                                                                                                                                                                                                                                                                                              |                  |          |                                                             |                                                    |                      |
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}$ , $I_D = 1\text{ mA}$<br>$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                                                                                                                                                                                | Q2<br>Q1         | 1<br>1   |                                                             | 3<br>3                                             | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$<br>$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$                                                                                                                                                                                                                                  | Q2<br>Q1         |          | -3.5<br>-5                                                  |                                                    | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain-Source On-Resistance              | $V_{GS} = 10\text{ V}$ , $I_D = 8.6\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $I_D = 8.6\text{ A}$ , $T_J = 125^\circ\text{C}$<br>$V_{GS} = 4.5\text{ V}$ , $I_D = 7.5\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $I_D = 6.3\text{ A}$<br>$V_{GS} = 10\text{ V}$ , $I_D = 6.3\text{ A}$ , $T_J = 125^\circ\text{C}$<br>$V_{GS} = 4.5\text{ V}$ , $I_D = 5.6\text{ A}$ | Q2<br><br><br>Q1 |          | 0.013<br>0.020<br>0.017<br>0.021<br>0.021<br>0.038<br>0.028 | 0.016<br>0.027<br>0.021<br>0.028<br>0.047<br>0.035 | $\Omega$             |
| $I_{D(on)}$                            | On-State Drain Current                         | $V_{GS} = 10\text{ V}$ , $V_{DS} = 5\text{ V}$                                                                                                                                                                                                                                                                                                               | Q2<br>Q1         | 30<br>20 |                                                             |                                                    | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 5\text{ V}$ , $I_D = 8.6\text{ A}$<br>$V_{DS} = 5\text{ V}$ , $I_D = 6.3\text{ A}$                                                                                                                                                                                                                                                                 | Q2<br>Q1         |          | 38<br>18                                                    |                                                    | S                    |
| <b>Dynamic Characteristics</b>         |                                                |                                                                                                                                                                                                                                                                                                                                                              |                  |          |                                                             |                                                    |                      |
| $C_{iss}$                              | Input Capacitance                              | $V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$                                                                                                                                                                                                                                                                                     | Q2<br>Q1         |          | 2040<br>815                                                 |                                                    | pF                   |
| $C_{oss}$                              | Output Capacitance                             |                                                                                                                                                                                                                                                                                                                                                              | Q2<br>Q1         |          | 615<br>186                                                  |                                                    | pF                   |
| $C_{rss}$                              | Reverse Transfer Capacitance                   |                                                                                                                                                                                                                                                                                                                                                              | Q2<br>Q1         |          | 216<br>66                                                   |                                                    | pF                   |

## Electrical Characteristics (continued)

$T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|--------|-----------|-----------------|------|-----|-----|-----|-------|
|--------|-----------|-----------------|------|-----|-----|-----|-------|

### Switching Characteristics (Note 2)

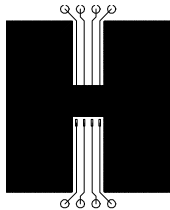
|              |                     |                                                                                          |    |  |      |    |    |
|--------------|---------------------|------------------------------------------------------------------------------------------|----|--|------|----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 15\text{ V}, I_D = 1\text{ A},$<br>$V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$ | Q2 |  | 10   | 18 | ns |
|              |                     |                                                                                          | Q1 |  | 10   | 18 |    |
| $t_r$        | Turn-On Rise Time   |                                                                                          | Q2 |  | 10   | 18 | ns |
|              |                     |                                                                                          | Q1 |  | 14   | 25 |    |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                          | Q2 |  | 34   | 55 | ns |
|              |                     |                                                                                          | Q1 |  | 21   | 34 |    |
| $t_f$        | Turn-Off Fall Time  |                                                                                          | Q2 |  | 14   | 23 | ns |
|              |                     |                                                                                          | Q1 |  | 7    | 14 |    |
| $Q_g$        | Total Gate Charge   | Q2<br>$V_{DS} = 15\text{ V}, I_D = 11.5\text{ A}, V_{GS} = 5\text{ V}$                   | Q2 |  | 17.5 | 26 | nC |
|              |                     |                                                                                          | Q1 |  | 8.5  | 12 |    |
| $Q_{gs}$     | Gate-Source Charge  | Q1<br>$V_{DS} = 15\text{ V}, I_D = 6.3\text{ A}, V_{GS} = 5\text{ V}$                    | Q2 |  | 6.3  |    | nC |
|              |                     |                                                                                          | Q1 |  | 2.4  |    |    |
| $Q_{gd}$     | Gate-Drain Charge   |                                                                                          | Q2 |  | 5.4  |    | nC |
|              |                     |                                                                                          | Q1 |  | 3.1  |    |    |

### Drain-Source Diode Characteristics and Maximum Ratings

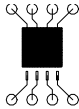
|          |                                                       |                                                                         |    |  |      |     |    |
|----------|-------------------------------------------------------|-------------------------------------------------------------------------|----|--|------|-----|----|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current |                                                                         | Q2 |  |      | 3.0 | A  |
|          |                                                       |                                                                         | Q1 |  |      | 1.3 |    |
| $t_{RR}$ | Reverse Recovery Time                                 | $I_F = 11.5\text{ A},$<br>$dI_F/dt = 300\text{ A}/\mu\text{s}$ (Note 3) | Q2 |  | 20   |     | ns |
| $Q_{RR}$ | Reverse Recovery Charge                               |                                                                         |    |  | 19.7 |     | nC |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 3\text{ A}$ (Note 2)                        | Q2 |  | 0.42 | .7  | V  |
|          |                                                       | $V_{GS} = 0\text{ V}, I_S = 6\text{ A}$ (Note 2)                        | Q2 |  | 0.56 |     |    |
|          |                                                       | $V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)                      | Q1 |  | 0.70 | 1.2 |    |

#### Notes:

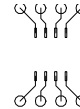
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $78^\circ\text{W}$  when mounted on a  $0.5\text{ in}^2$  pad of 2 oz copper



b)  $125^\circ\text{W}$  when mounted on a  $.02\text{ in}^2$  pad of 2 oz copper



c)  $135^\circ\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty Cycle  $< 2.0\%$

3. See "SyncFET Schottky body diode characteristics" below.

## Typical Characteristics: Q2

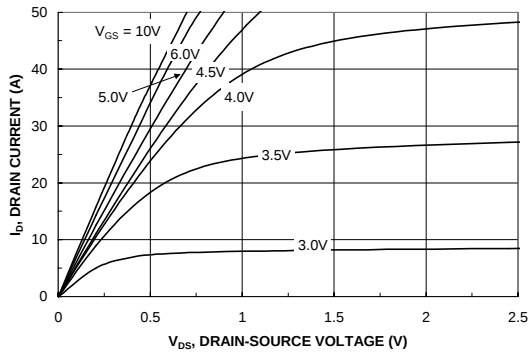


Figure 1. On-Region Characteristics.

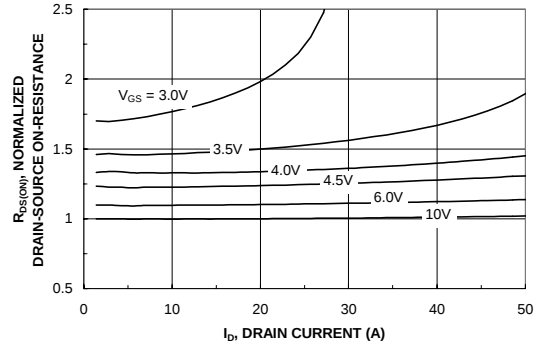


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

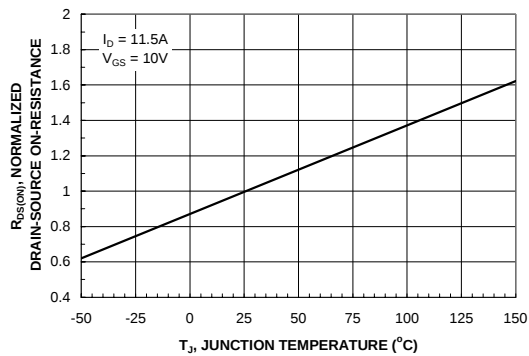


Figure 3. On-Resistance Variation with Temperature.

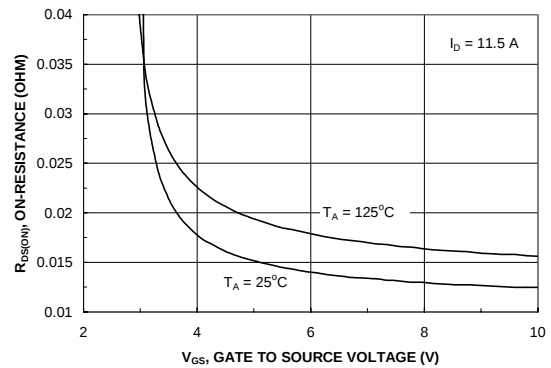


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

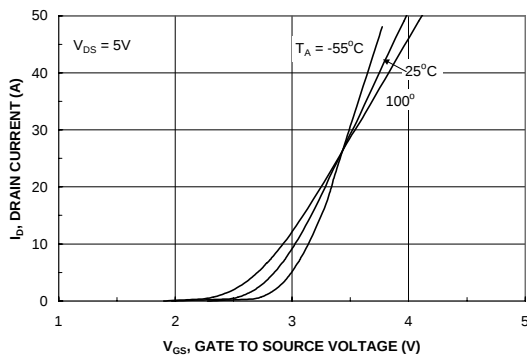


Figure 5. Transfer Characteristics.

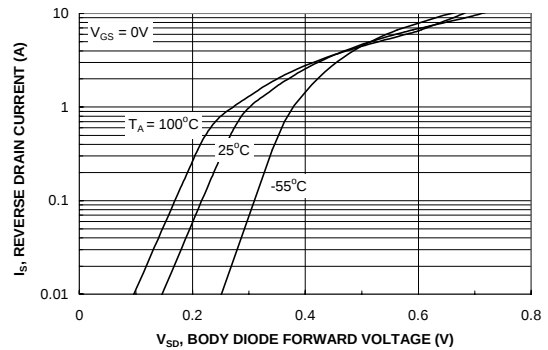


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics: Q2

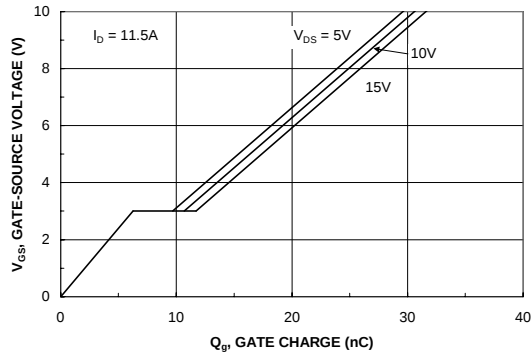


Figure 7. Gate Charge Characteristics.

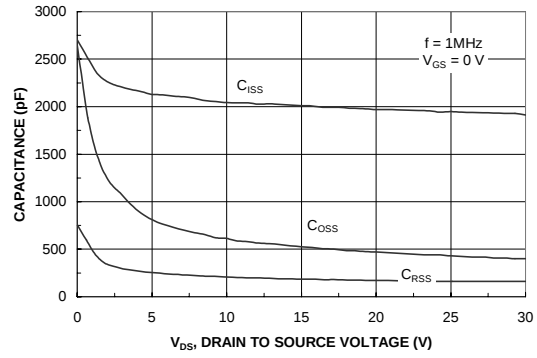


Figure 8. Capacitance Characteristics.

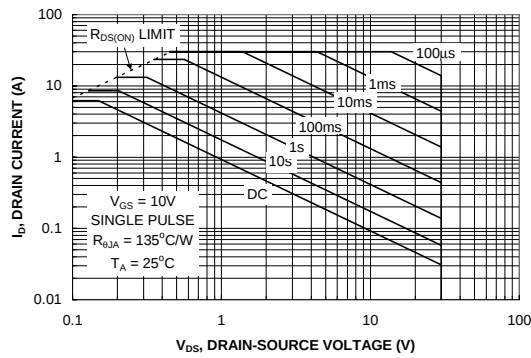


Figure 9. Maximum Safe Operating Area.

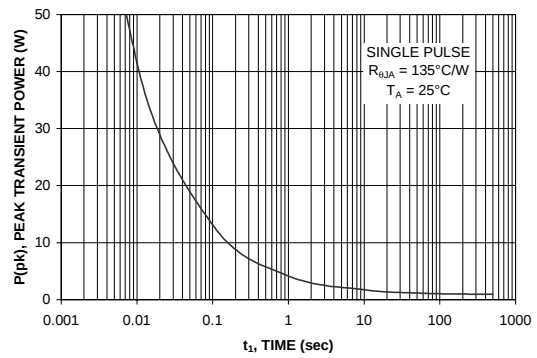


Figure 10. Single Pulse Maximum Power Dissipation.

# Typical Characteristics Q1

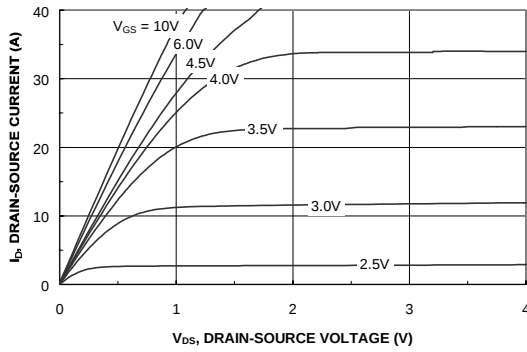


Figure 11. On-Region Characteristics.

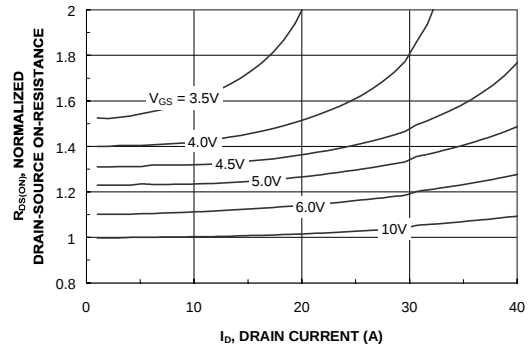


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

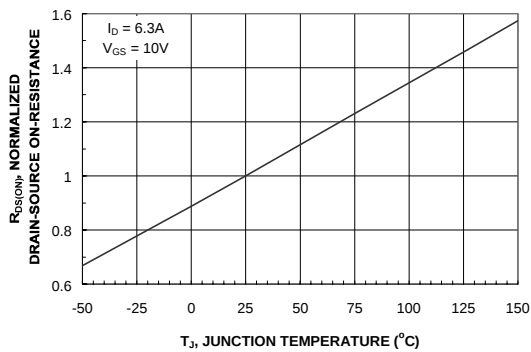


Figure 13. On-Resistance Variation with Temperature.

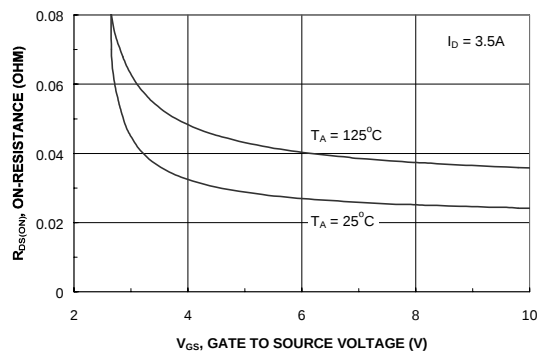


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

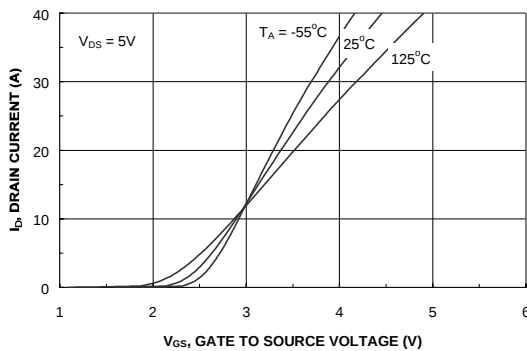


Figure 15. Transfer Characteristics.

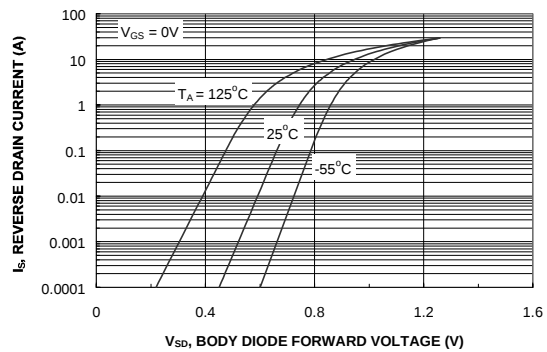


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

# Typical Characteristics Q1

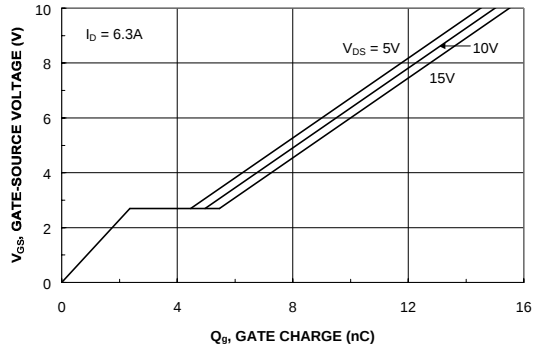


Figure 17. Gate Charge Characteristics.

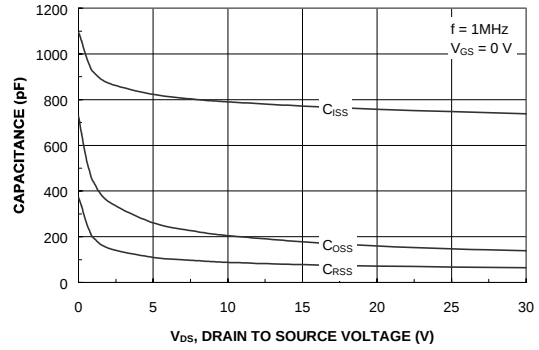


Figure 18. Capacitance Characteristics.

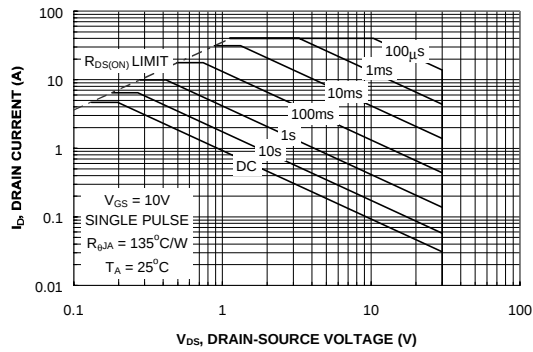


Figure 19. Maximum Safe Operating Area.

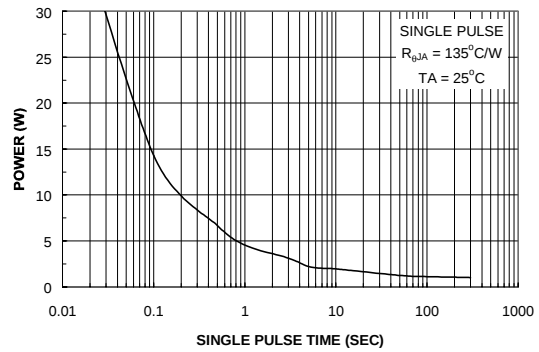


Figure 20. Single Pulse Maximum Power Dissipation.

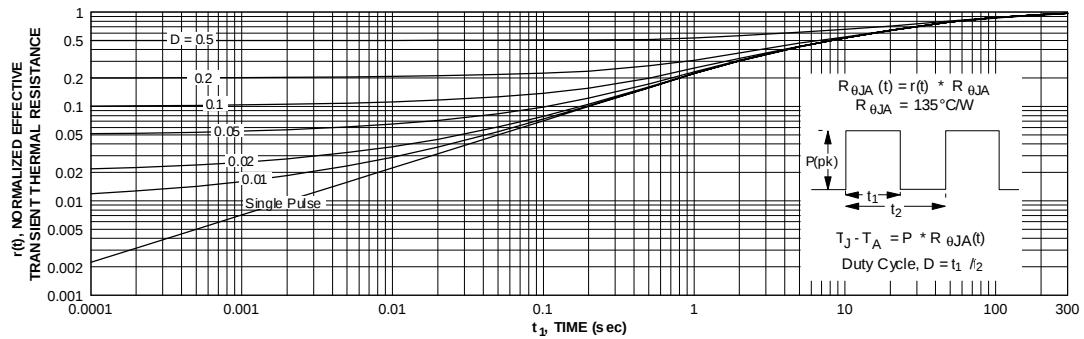


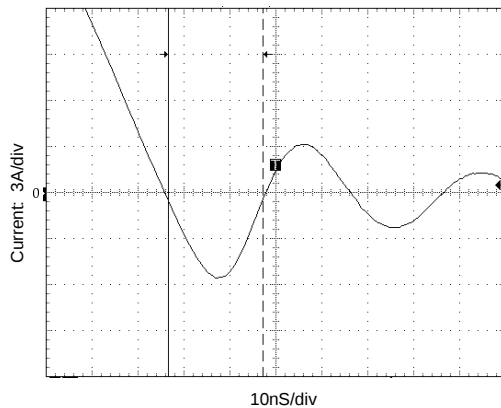
Figure 21. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c.  
Transient thermal response will change depending on the circuit board design.

## Typical Characteristics (continued)

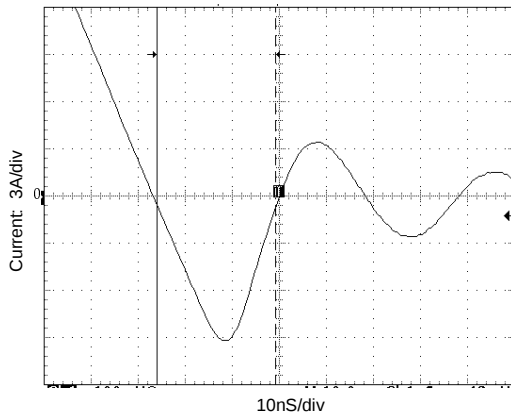
### SyncFET Schottky Body Diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 12 shows the reverse recovery characteristic of the FDS6982S.



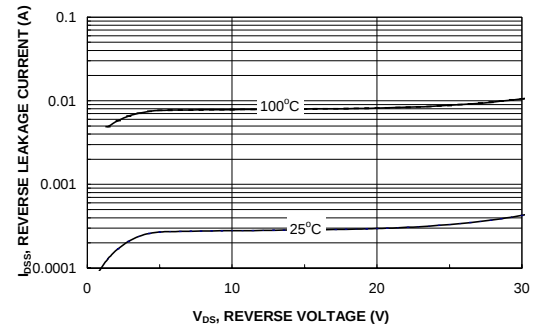
**Figure 12. FDS6982S SyncFET body diode reverse recovery characteristic.**

For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET (FDS6982).



**Figure 13. Non-SyncFET (FDS6982) body diode reverse recovery characteristic.**

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

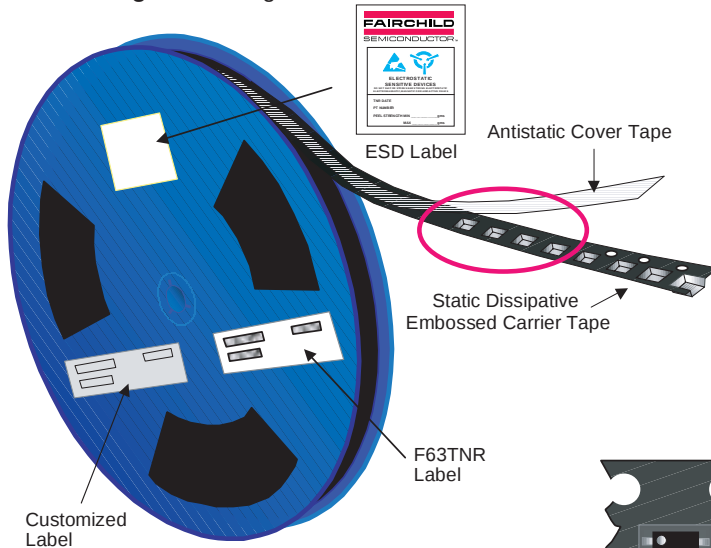


**Figure 14. SyncFET body diode reverse leakage versus drain-source voltage and temperature.**

# SO-8 Tape and Reel Data and Package Dimensions



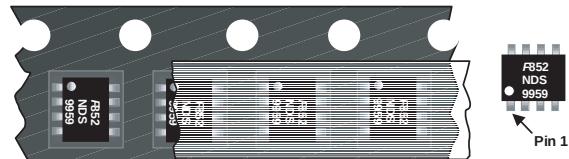
## SOIC(8lds) Packaging Configuration: Figure 1.0



### Packaging Description:

SOIC-8 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 2,500 units per 13" or 330cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 500 units per 7" or 177cm diameter reel. This and some other options are further described in the Packaging Information table.

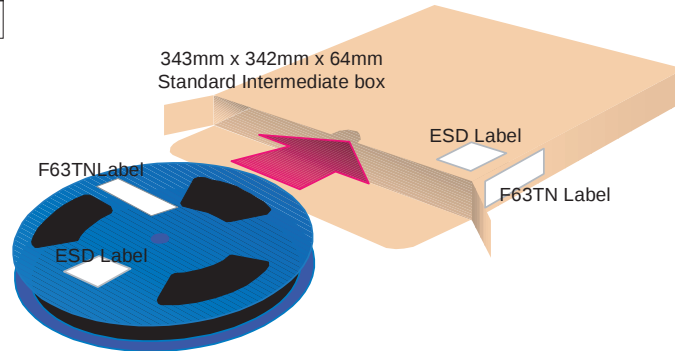
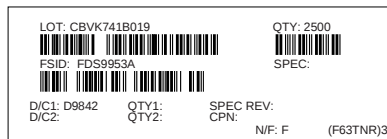
These full reels are individually barcode labeled and placed inside a standard intermediate box (illustrated in figure 1.0) made of recyclable corrugated brown paper. One box contains two reels maximum. And these boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.



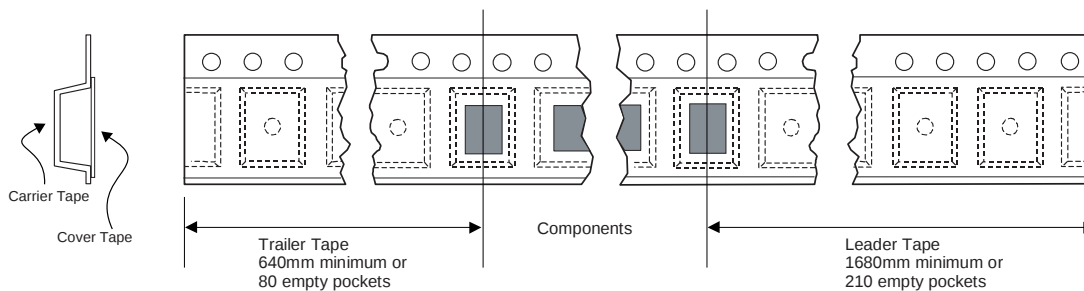
### SOIC-8 Unit Orientation

| SOIC (8lds) Packaging Information |                         |            |            |            |
|-----------------------------------|-------------------------|------------|------------|------------|
| Packaging Option                  | Standard (no flow code) | L86Z       | F011       | D84Z       |
| Packaging type                    | TNR                     | Rail/Tube  | TNR        | TNR        |
| Qty per Reel/Tube/Bag             | 2,500                   | 95         | 4,000      | 500        |
| Reel Size                         | 13" Dia                 | -          | 13" Dia    | 7" Dia     |
| Box Dimension (mm)                | 343x64x343              | 530x130x83 | 343x64x343 | 184x187x47 |
| Max qty per Box                   | 5,000                   | 30,000     | 8,000      | 1,000      |
| Weight per unit (gm)              | 0.0774                  | 0.0774     | 0.0774     | 0.0774     |
| Weight per Reel (kg)              | 0.6060                  | -          | 0.9696     | 0.1182     |
| Note/Comments                     |                         |            |            |            |

### F63TNR Label sample

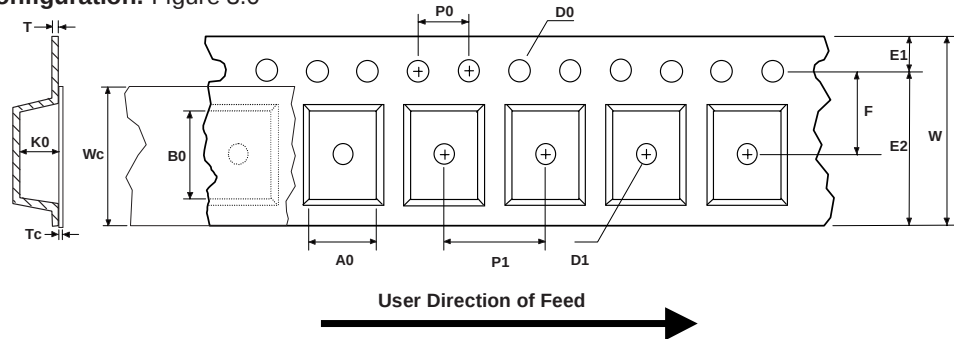


## SOIC(8lds) Tape Leader and Trailer Configuration: Figure 2.0



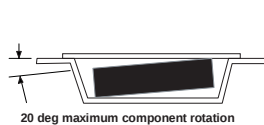
## SO-8 Tape and Reel Data and Package Dimensions, continued

### SOIC(8lds) Embossed Carrier Tape Configuration: Figure 3.0

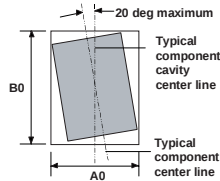


| Dimensions are in millimeter |                 |                 |                |                 |                 |                 |              |                 |               |               |                |                       |               |                 |
|------------------------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|--------------|-----------------|---------------|---------------|----------------|-----------------------|---------------|-----------------|
| Pkg type                     | A0              | B0              | W              | D0              | D1              | E1              | E2           | F               | P1            | P0            | K0             | T                     | Wc            | Tc              |
| SOIC(8lds)<br>(12mm)         | 6.50<br>+/-0.10 | 5.30<br>+/-0.10 | 12.0<br>+/-0.3 | 1.55<br>+/-0.05 | 1.60<br>+/-0.10 | 1.75<br>+/-0.10 | 10.25<br>min | 5.50<br>+/-0.05 | 8.0<br>+/-0.1 | 4.0<br>+/-0.1 | 2.1<br>+/-0.10 | 0.450<br>+/-<br>0.150 | 9.2<br>+/-0.3 | 0.06<br>+/-0.02 |

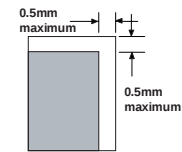
Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)  
Component Rotation

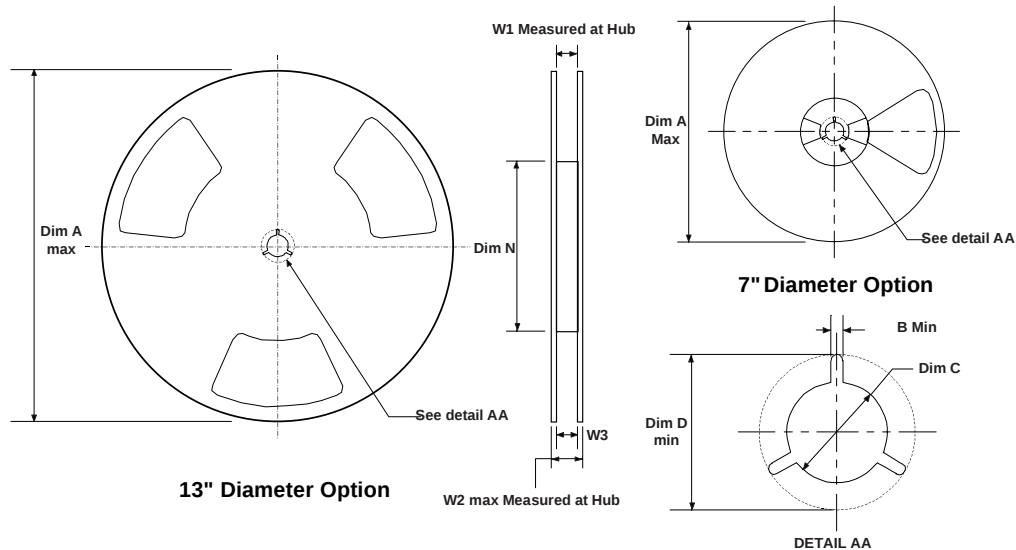


Sketch B (Top View)  
Component Rotation



Sketch C (Top View)  
Component lateral movement

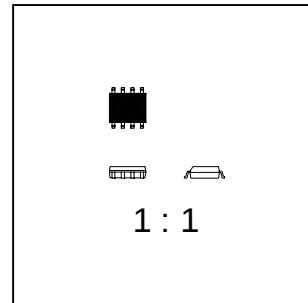
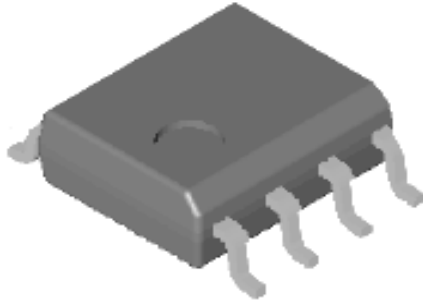
### SOIC(8lds) Reel Configuration: Figure 4.0



| Dimensions are in inches and millimeters |             |               |              |                                   |               |             |                                  |               |                              |
|------------------------------------------|-------------|---------------|--------------|-----------------------------------|---------------|-------------|----------------------------------|---------------|------------------------------|
| Tape Size                                | Reel Option | Dim A         | Dim B        | Dim C                             | Dim D         | Dim N       | Dim W1                           | Dim W2        | Dim W3 (LSL-USL)             |
| 12mm                                     | 7" Dia      | 7.00<br>177.8 | 0.059<br>1.5 | 512 +0.020/-0.008<br>13 +0.5/-0.2 | 0.795<br>20.2 | 2.165<br>55 | 0.488 +0.078/-0.000<br>12.4 +2/0 | 0.724<br>18.4 | 0.469 - 0.606<br>11.9 - 15.4 |
| 12mm                                     | 13" Dia     | 13.00<br>330  | 0.059<br>1.5 | 512 +0.020/-0.008<br>13 +0.5/-0.2 | 0.795<br>20.2 | 7.00<br>178 | 0.488 +0.078/-0.000<br>12.4 +2/0 | 0.724<br>18.4 | 0.469 - 0.606<br>11.9 - 15.4 |

### SO-8 Tape and Reel Data and Package Dimensions, continued

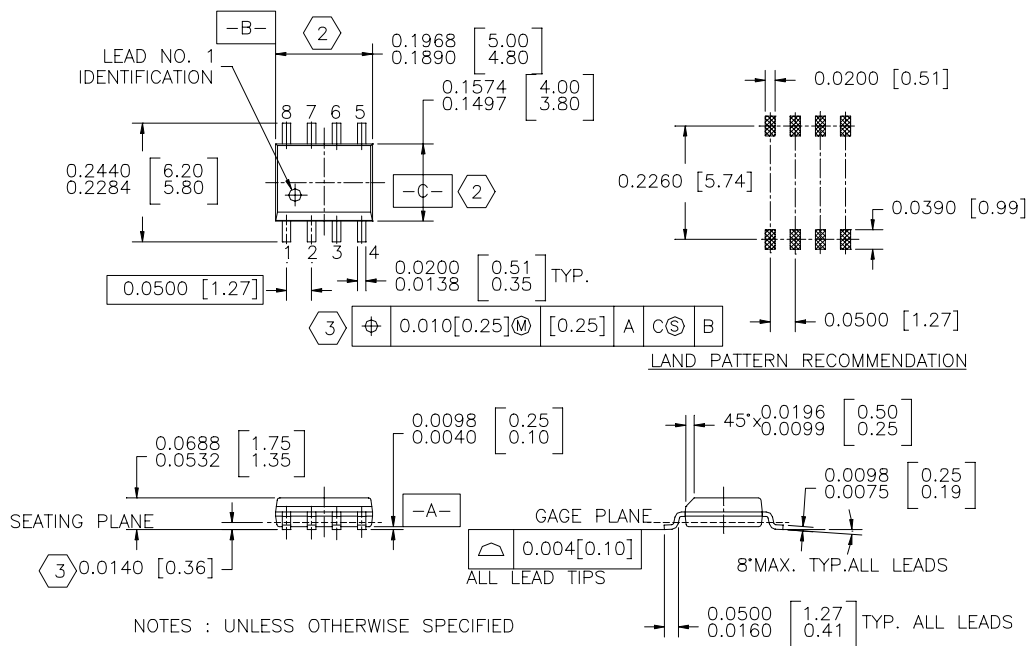
## SOIC-8 (FS PKG Code S1)



Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.0774



NOTES : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH:  
200 MICROINCHES / 5.08 MICRONS MINIMUM  
LEAD / TIN (SOLDER) ON COPPER.

SO 0.150 WIDE 8 LEADS

2. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH

3. MAXIMUM LEAD 0.024 [0.609]

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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|--------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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